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DECAY AND SEED TREES IN THE DOUGLAS FIR REGION

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The policy of the North Pacific District of leaving decayed trees to serve as seed trees in the Douglas fir type on cut-over areas has been for some time the subject of such repeated comment and question that a detailed statement of the factors dictating this policy seems advisable. Much of the misunderstanding comes from lack of knowledge of conditions in this region on the part of the questioners. Throughout this discussion three things must be kept clearly in view: (1) that leaving decayed trees for seed is practiced only in the typical, even-aged Douglas fir stands west of the summit of the Cascade Mountains and north of the Umpqua-Rogue River divide; (2) that it is applied only to the present overmature stands from 200 to 500 years or more in age; and (3) that the decays under consideration attack the dead heartwood alone and do not encroach upon the living sapwood.

Decay is very prevalent in the overmature stands of Douglas fir which are so abundant throughout this region. While an occasional stand is relatively sound, a loss of 20 per cent from decay is not uncommon, and in certain cases the cull figure may be 50 per cent or even more. Study (1) has shown that this great loss chiefly results from red ring rot, known locally as conk rot, caused by the ring scale fungus (*Trametes pini*). This fungus fruits abundantly so that infected trees usually bear several to many living sporophores. In 169 over-mature Douglas firs with a loss of 45 per cent in merchantable volume from decay, it was found that red ring rot was responsible for 39 per cent, red-brown butt rot caused by the velvet top fungus (*Polyporus schweinitzii*) for 2.5 per cent, brown trunk rot caused by the quinine fungus (*Fomes laricis*) for 2 per cent, and yellow brown top rot caused by the rose-colored Fomes (*Fomes roseus*) for the remaining 1.5 per cent.

Discussions of the influence of the mother tree on seed are sometimes marked by a lack of clarity as to just what is meant by a diseased tree. Trees infected with fungus and phanerogamic parasites that actually kill or deform the roots, branches, twigs, leaves, or the entire tree are certainly diseased and undesirable for seed trees. However, it is questionable if decayed trees with the dead, mechanically support-

ing heartwood alone affected by a fungus are diseased in the true sense when disease is considered as any disturbance of the normal functions of a living tree.

Two objections are invariably offered to leaving decayed trees as seed trees. The first is that such trees will spread decay to the future stand. In the Douglas fir region this objection becomes academic. As long as the present method of clear cutting Douglas fir prevails, future stands will be cut before the trees attain an age at which they become subject to extensive decay even though exposed to infection. It is doubtful if in the future the rotation for Douglas fir will go beyond 100 years except in rare instances, and normally it will probably fall a decade or more below that age. Throughout western Oregon and Washington, stands of second growth Douglas fir up to 100 years old commonly have less than 1 per cent of their merchantable volume destroyed by decay, even though old veterans, survivors of the previous stand, covered with living sporophores releasing myriads of wind-borne, infecting spores are scattered through them, or the young stands are immediately adjacent to badly decayed, overmature stands from which infection can spread at will. Furthermore, the small amount of decay found in these second growth stands is mostly red-brown butt rot entering through fire scars rather than red ring rot entering through dead branch stubs and knots which is responsible for most of the decay in overmature trees.

It may be that planted stands of the future will have an appreciable loss from decay at a much earlier age than the present naturally reproduced second growth. European experience points to this, with severe losses occurring in stands 60 years old or even less. However, it is to be hoped that our Douglas fir stands of the future will be naturally reproduced, since placing the Douglas fir region on a clear-cutting and planting basis, knowing the high susceptibility of planted stands in other regions to disease and insect attack, as compared with naturally reproduced stands, should be undertaken only if all other means fail. The method for reproducing the future stands when the forests of this region are brought under regulation has not yet been carefully considered. There has been and is so much to work out in order to handle the present overmature stands properly to insure adequate stocking on cut-over land that the more distant problem must be neglected for the present.

The second objection is that seedlings from seed produced by these decayed trees will be below average in thrift. This can be determined only by a long-time experiment, comparing the growth of progeny

from decayed trees with those from sound trees from the same location and of the same age and degree of vigor. This has not yet been done. Willis and Hofmann (2, p. 158) have shown a slightly decreased growth on seedlings from decayed (conky) mother trees as compared to those from normal trees, but this is based on measurements for only the first two years' growth in the nursery beds. It is not impossible that when such an investigation is carried through, no difference will be found in the seed from decayed and sound trees of equal vigor because the decays in Douglas fir confine themselves to the dead heartwood and it may be that no influence is exercised on the vital functions of the tree. Of course, in opposition to this idea remains the fact that of two trees of equal age and size standing side by side, one can be completely decayed and the other entirely sound. If we refuse to attribute this difference entirely to the chances of infection, then the sound tree must be credited with resistance to decay and this resistance must be either inherent in the heartwood from the time it changed from sapwood, or living portions of the tree must have an intangible influence on the dead heartwood.

Furthermore, Douglas fir reproduction on cut-over land must come from seed stored in the forest floor for a few years previous to cutting, from scattered seed trees left after cutting, from seed dropped by the trees just previous to logging, or by seeding in from the adjacent uncut stand. This problem is now under investigation by the Pacific Northwest Forest Experiment Station, and present belief is that on the whole the last three methods are the most important. Scattered seed trees alone would not reproduce an area quickly unless their numbers were large, nor exclusively unless other sources were lacking. Granting these premises, then, if the original stand contains decayed trees, seedlings from this seed source that cannot be regulated will form a proportionate part of the future stand in spite of anything that can be done. Even if it did appear that the progeny of decayed trees was of poor quality, there is always the possibility that the cones on sound seed trees that are left will be cross fertilized by pollen from decayed trees growing on the adjoining tract. The areas of continuous, absolutely clear-cut tracts are not large enough to preclude the introduction from the outside either of spores of the wood-destroying fungi or of pollen of infected trees.

If sound seed trees are left a large proportion of them will not survive to the next rotation. Some will be killed by the slash fire following logging, others will be windthrown, and some will die slowly from the severe shock of sudden exposure by the removal of the sur-

rounding stand. This loss will normally far more than offset the increase in volume through growth of the survivors. Furthermore, the space occupied by seed trees in this region of abundant soil moisture is not so important, since reproduction will grow very close to the base of scattered, overmature trees.

On private lands, leaving decayed trees serves a double purpose. It permits the operator to reduce his logging costs by leaving trees which will yield no lumber and serve for seed trees where the land is held for future timber growth. It must be remembered that on such lands the choice must be made between decayed seed trees or no seed trees, for the private owner is not convinced that timber growing will pay sufficiently to warrant a capital investment in sound seed trees. Furthermore, some operators will leave decayed trees under any circumstances to avoid the cost of felling them and without any intention of reserving seed trees.

When Douglas fir occurs in uneven-aged mixed stands as in eastern Washington and eastern and southern Oregon, an entirely different silvicultural system must be followed. Here the modified selection system as now practiced leaves, after cutting, a number of trees which will have passed the age at which they are liable to extensive decay before the next cutting cycle is reached. It follows then that all trees with extensive decay at the time of cutting, and particularly those bearing sporophores, whether partially or completely unmerchantable, should be removed to prevent their spreading decay and causing loss to the future stand. Aside from pathological considerations, such specimens demand removal, since these worthless trees will occupy valuable space in an, at best, partially stocked stand, while the suppressing effect of large trees on the surrounding reproduction, particularly of the most valuable species, western yellow pine, is only too apparent in this generally dry region where root competition for moisture is particularly severe.

The same wood-destroying fungi are important in western yellow pine, sugar pine, lodgepole pine, Douglas fir, and western larch, and it must be assumed until proven otherwise that the same decay from one tree species is capable of infecting all the other species. Consequently, when these species grow in mixture, it is necessary to remove all decayed trees in order to protect any one or all of the species. On the other hand, the Indian paint fungus (*Echinodontium tinctorium*) causing stringy brown rot so wide-spread and serious in white fir and western hemlock does not attack any of the foregoing, except in rare instances Douglas fir, while the fungus (*Polyporus amarus*) causing dry-

rot of incense cedar is confined to that host alone. Consequently, if absolutely necessary, decayed white firs and incense cedars can be left without danger to other species, realizing, of course, that they occupy space that would be valuable for thrifty young growing stock and that they increase the percentage of the less desirable species in reproduction.

It is essential that decayed trees be eliminated from our stands as rapidly as possible, but occasions may arise when exceptions may seem desirable in which the leaving of such trees may be a logical temporary practice. Such an exception to the general principles seems justifiable in the Douglas fir region of the Pacific Northwest during the period of transition from virgin, overmature stands to regulated second growth.

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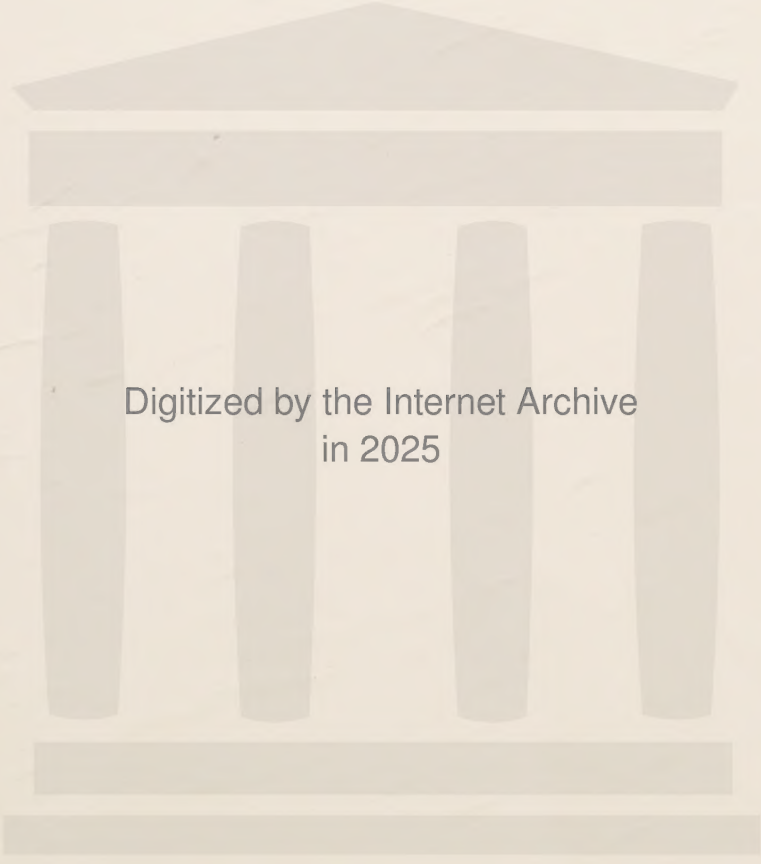
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